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ORIUS MINUTUS (LINNAEUS) IN NORTH AMERICA (HEMIPTERA: HETEROPTERA: ANTHOCORIDAE)

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Abstract.—The history and present distribution of *Orius minutus* (Linnaeus) in North America is summarized. The systematic position of *O. minutus* is reviewed, showing that this introduced species is the only member of the subgenus *Heterorius* Wagner in North America. The adult and nymph of *O. minutus* are illustrated and distinguished from the native sympatric species *Orius tristicolor* (B.-White). The ecology and potential benefits of *O. minutus* as a predator in agroecosystems are discussed.

Orius minutus (Linnaeus) is a Palearctic species of Anthocoridae that has been introduced accidentally into western North America. According to Péricart (1972) its natural distribution is Europe and western Russia, North Africa, east to Turkestan, China and Siberia. Precise information is often lacking because of taxonomic confusion with other species of *Orius* in that vast area.

Tonks (1953) first reported the species from North America, based on specimens collected on Lulu Island and Huntingdon, in the vicinity of Vancouver, British Columbia. The specimens were collected on raspberry and loganberry in 1951. Anderson (1962) added records from Victoria and the lower Fraser Valley from Vancouver to Hope, British Columbia and also reported the species from Seattle and Bothell, Washington and Albany, Oregon. He suggested that it had been recently introduced to the Pacific Coast region, stating that the earliest specimens he had examined had been collected in 1939. Kelton (1963, 1978), Herring (1966) and Henry (1988) based their records on the publications of Tonks and Anderson.

The earliest record we have seen is based upon a specimen in the OSU, Systematic Entomology Laboratory, collected in Seattle, Washington on 29 July 1930 by the late M. H. Hatch. Collection records are clustered in the following areas (earliest collection dates in parentheses): Seattle, Washington (1930); Vancouver, British Columbia (1951); Portland, Oregon and the Willamette Valley, Oregon (1957) (Fig. 1). The earliest records for Hood River County, Oregon date from 1971. While the possibility of three separate introductions exists (Seattle, Vancouver and Portland), the species seems to occur chiefly in agroecosystems, particularly on fruit trees and shrubs, so that an alternative hypothesis would be a single introduction and establishment followed by dispersal via movement of plant material through commerce and some normal dispersal. *O. minutus* seems well established from at least the Willamette Valley, Oregon north to the Vancouver, British Columbia region and east up the Columbia River to at least Hood River.

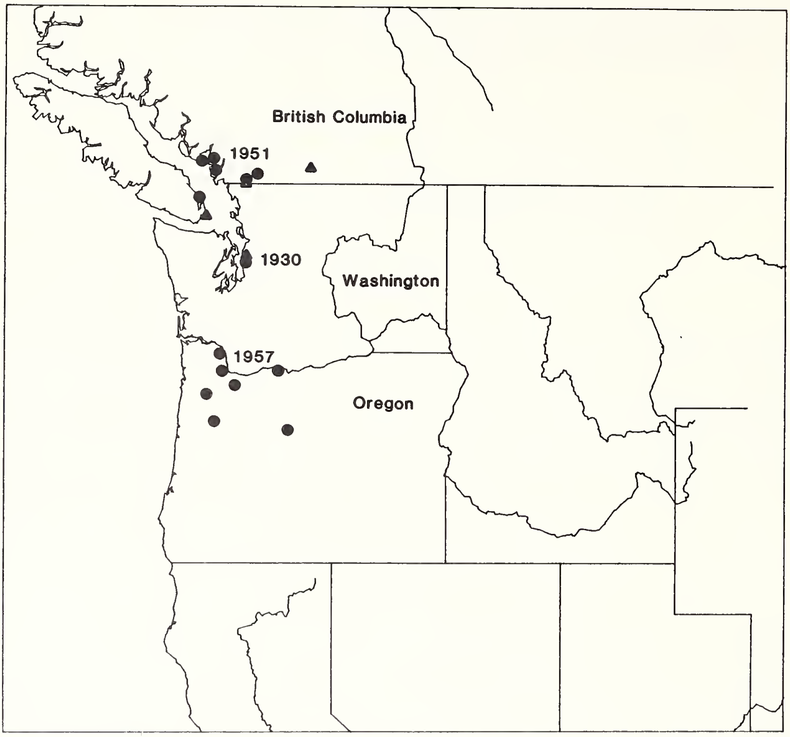

Fig. 1. Distribution of *Orius minutus* in the Pacific Northwest with localities and dates of the earliest known specimens. Solid circles represent specimens examined. Solid triangles represent literature records.

SPECIMENS EXAMINED

British Columbia. Milner, 1958 (G. J. Spencer) (UBC); Bowen Is., 24 April 1960 (G. J. Spencer) (UBC); Lions Bay, Vancouver, 22 May 1961 (G. J. Spencer) (UBC); Vancouver, 2 July 1961 (G. J. Spencer) (UBC); Vancouver, 2 July 1961 (G. J. Spencer) (UBC); Vancouver, 28 September 1976 (G. G. E. Scudder) (UBC); Vancouver, 23 October 1978 (J. Scudder) (UBC); Galiano Is., North end, 18 August 1982 (G. G. E. Scudder); Vancouver, 3 August 1983 (G. G. E. Scudder) (UBC); Spanish Hills, Galiano Is., 15 August 1983 (G. G. E. Scudder) (UBC); 10 mi E. Mission City, 31 July 1957, ex Hazel (N. Anderson) (OSU-SEL); OREGON: Benton Co.: 1 mi N Corvallis, Hwy 99W, ex. *Corylus,* 10 May 1989 (A. Asquith) (OSU-SEL); Clackamas Co.: 8 mi E Oregon City, sweeping potatoes. 3 August 1962 (H. E. Morrison, R. F. Koontz) (OSU-SEL); Columbia Co.: Beaver, rose bloom, 6 July 1967 (K. Goeden) (OSDA); Hood River Co.: Hood River, 23 July 1971, ex. Aphid infested apple leaf (R. W. Zwick) (MCAREC); Hood River, 10 January 1972, ex. cardboard band of pear tree (G. J. Fields) (MCAREC); Hood Riv. Exp. Station, 30 April 1981, ex pear (MCAREC); Hood River, Power Block, 13 July to 18 September 1988, ex. pear (S. Booth) (MCAREC); Hood River, Power Block, MCAREC, 9 August 1988, ex. oak (S. Booth) (OSU); Jefferson Co.: Culver, 20 July 1962, sweeping grass and potatoes (R. F. Koontz) (OSU-SEL); Linn Co.: 7 mi NE Albany, 5 June 1957, ex. raspberry (J. D. Lattin) (OSU-SEL); Yamhill Co.: McMinnville, Peavine Ridge, 29 May 1958, ex. *Opulaster capitatus* (K. Fender) (OSU-SEL); Washington Co.: 5 mi n N. Plains, 10 August 1960 (J. D. Lattin) (OSU-SEL); WASHINGTON: Seattle, 29 July 1930 (M. H. Hatch) (OSU-SEL); 7 May 1931; 2 July 1931 (M. H. Hatch) (OSU-SEL); 27 May 1933 (L. C. Snyder) (OSU-SEL); July 1961; Seattle (T. Kincaid) (OSU-SEL); U. W. Campus, 27 April 1937 (OSU-SEL); 8 April 1938 (E. Dailey); 7 April 1938 (Patterson) (OSU-SEL); 4 May 1948 (M. H. Hatch) (OSU-SEL); 12 April 1961; 1 May 1964.

SYSTEMATIC POSITION

The genus *Orius* was described by Wolff in 1811 and contains about 70 species (Péricart, 1972). Wagner (1952) proposed the subgenus *Heterorius* with *Cimex minutus* Linneaus as the type. Kelton (1963) produced a synopsis of the species of *Orius* of Canada and the United States and included *O. minutus.* No mention of subgeneric placement was made for any of the species. Herring (1966) published a review of *Orius* for the Western Hemisphere and included a key to the subgenera following Wagner (1952). He stated that many of the New World species could not be placed in these four taxa, and remarked that all of the species treated but one fit the characters proposed for the subgenus *Heterorius,* but felt that the claspers of the males of these species did not conform to the European species included in *Heterorius.* Herring did not propose a revision of the Wagner classification to include the New World species. Henry (1988) followed Herring and cited the latter author's remarks about the unsuitability of the Wagner classification for the North American fauna. Our investigations confirm Herring's supposition; all palearctic species in the subgenus *Heterorius* have a well defined spine at the base of the male clasper and all North American species lack this structure. Thus, as an introduction, *O. minutus* is the only representative of *Heterorius,* as presently defined, in North America.

DIAGNOSTICS

Adults. O. minutus adult females are large (2.05–2.60 mm total length) and broadly ovate (0.85–0.97 mm pronotal width) (Fig. 2). The head is dark brown to black with yellow antennae. The pronotum and scutellum are fuscous to piceous, with the hemelytra yellowish brown. The venter is fuscous to black, with the anterior and middle legs yellow and hind legs brown to fuscous. The dorsum is rather thickly clothed with long semi-erect golden setae. Adult males are more slender (0.7–0.82 mm pronotal width) with thicker antennae.

The other common species of *Orius* in the Pacific Northwest, *O. tristicolor* (B.-White), is slightly smaller (1.82–2.29 mm total length) and more linear (0.66–0.83 mm pronotal width). It is dark brown to black on the head, pronotum, scutellum, clavus, the apical one third of the corium and the cuneus, with the antennae and basal half of the corium a contrasting pale white. The entire ventral surface is also solid black with only the front and middle tibia and tarsi white. The dorsal surface is covered with much shorter and more sparsely distributed decumbent pale setae.

Nymphs. Fifth instar nymphs of *O. minutus* can be distinguished from *O. tristicolor*

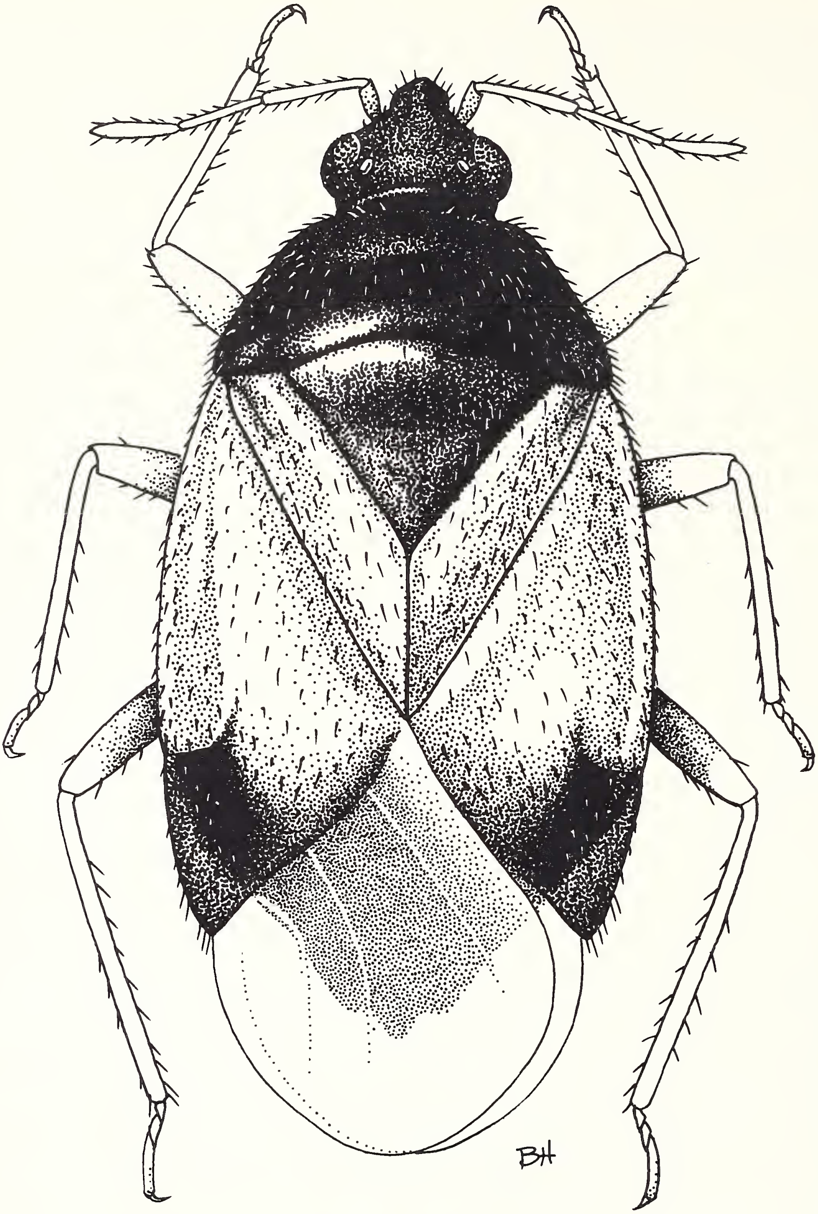

Fig. 2. *Orius minutus.* Dorsal habitus of adult female.

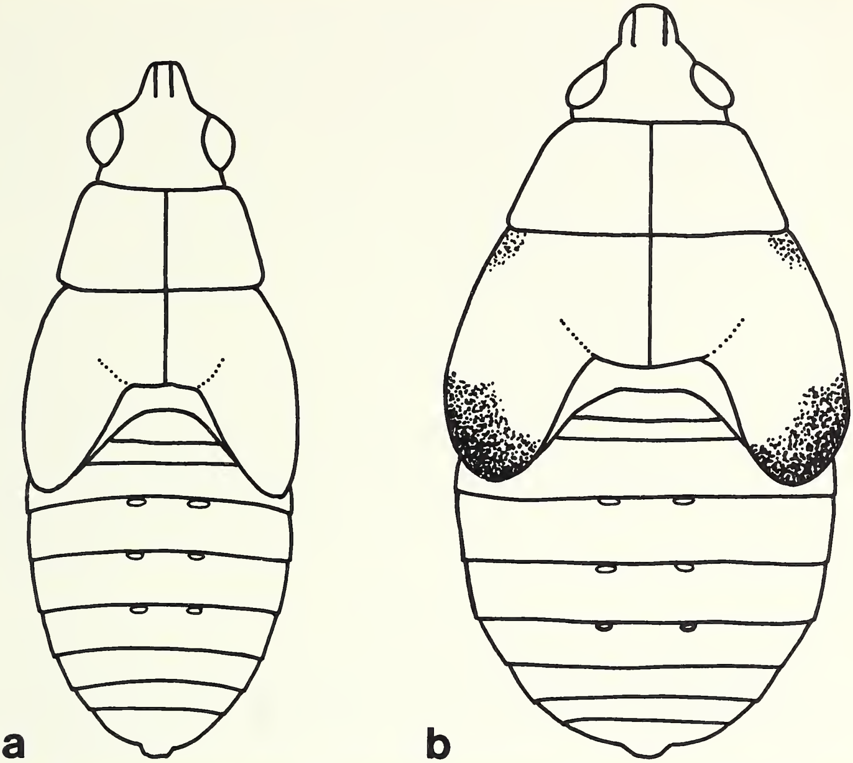

Fig. 3. Fifth instar nymphs of *Orius* spp. Dorsal habitus. A. *O. tristicolor*. B. *O. minutus*.

by their broadly ovate form with the apical one third of the wing pads much darker than the rest of the dorsum (Fig. 3). *O. tristicolor* nymphs are slightly smaller, more linear and uniformly reddish brown in coloration. Badly bleached specimens can be distinguished by the maximum width of the pronotum, which in *O. minutus* is 0.70 mm or greater and in *O. tristicolor* 0.60 mm or less.

Earlier instars are more difficult to distinguish, as both species are usually creamy white in color. *O. minutus* is always broader and more robust, the maximum width of the pronotum almost 1.5 times the width of the head. In *minutus,* the head is short, and the eyes almost touch the anterior margin of the pronotum. Early instar nymphs of *tristicolor* are more slender, the width of the head only slightly less than or equal to the width of the pronotum. The head is longer and the eyes are separated from the anterior margin of the pronotum by at least the width of the fourth antennal segment.

FEEDING HABITS

Orius minutus is chiefly predacious, as are most Anthocoridae (Péricart, 1972; Cobben, 1978; Kelton, 1978). Fulmek (1930) studied the development of this species in Austria and reported several species of aphids as prey. Tonks (1953) reported "... mites, thrips, leafhoppers, and other small insects," and Collyer (1953) reported the fruit tree red spider mite (*Metatetranychus ulmi* (Koch)) as prey in English orchards. Southwood and Leston (1959) also report mites and small insects as prey. Anderson (1962) observed *O. minutus* feeding on the two-spotted spider mite, *Tetranychus telarius* (L.) on raspberry in Orgeon. Péricart (1972) reported aphids, psyllids, jassids, thrips, mites and the eggs of pentatomids and Lepidoptera as prey items. Kelton (1978) listed a number of herbs and shrubs in British Columbia that provided a habitat for *O. minutus* while it fed on a variety of mites and insects.

While the Anthocoridae are considered to be predators, considerable evidence indicates that some are partially phytophagous (see for example: Carayon and Steffan, 1959; Anderson, 1962; Chu, 1969; Fauvel, 1974; Péricart, 1972; Bachelor and Baranowski, 1975; Cobben, 1978). Several genera of the Oriini (*Orius* Wolff and *Paratriphleps* Champion) have been reported to feed on plant materials. Xambeu (1903) (cited in Butler, 1923 and Fulmek, 1930) reported *Orius minutus* feeding on plant fluids (*Eryngium campestre*) as well as aphids, as did Fulmek (1930) and Péricart (1972). Fauvel (1970) reported *Orius vicinus* (Ribaut) (also in the subgenus *Heterorius*) feeding on a number of plants besides feeding on mites and aphids, and provided interesting illustrations of pollen and beak tips, showing relative sizes. Carayon and Steffan (1959) found that *Orius pallidicornis* (Reuter) was primarily phytophagous, feeding on the pollen of *Ecballium elaterium* Rich. Dicke and Jarvus (1962) discovered the importance of corn pollen in building up populations of *Orius insidiosus* (Say) in Ohio. Bachelor and Baranowski (1975) were able to rear *Paratriphleps laeviusculus* Champion successfully on the flowers and pollen of *Manilkara zapotilla* (Jacq.) Gilly in Florida. Any consideration of Anthocoridae as biological control agents should consider potential plant food sources as well as conventional prey items.

LIFE HISTORY

Orius minutus overwinters as a fertilized female, usually emerging from hibernation in March and April in Europe (Collyer, 1953). Some males may also hibernate. Egg laying occurs shortly after hibernation ends, the eggs being deposited in the midrib on the ventral side of the leaves of "host" plants (Collyer, 1953) or at the base of developing flower buds (Fulmek, 1930). Fulmek (1930) provides excellent figures of the eggs and nymphs of *O. minutus,* as does Péricart (1972) who also includes drawings of the adult male and female. There are five nymphal instars. The developmental time from oviposition to adult varied from 24 to 30 days in England (Collyer, 1953). There appears to be continuous reproduction through the season until fall when the females that will overwinter are fertilized. At least two generations a year occur (Collyer, 1953), but possibly three or four (Péricart, 1972). Both phytophagous and predaceous feeding habits are recorded. The seasonal phenology of *O. minutus* in North America has not yet been detailed. Adults have been collected from early April to mid-September however, suggesting that the species is bivoltine.

Orius minutus is a potentially beneficial introduction, particularly in cane and orchard crops. If it continues to expand its range and numbers in the Pacific Northwest it may prove to be an important addition to the predator complex of fruit crops. For example, its present distribution in the fruit-producing Hood River Valley of Oregon appears to be limited. In a survey of the arthropod generalist predators inhabiting unsprayed pear (Booth, unpubl. data), this species was found almost exclusively at elevations less than 1,000 ft. At the Mid-Columbia Agricultural Research and Extension Center, weekly observations were made in a small block of unsprayed D'Anjou pear trees adjacent to a diverse vegetative community dominated by oak and pine. Although *O. minutus* nymphs were not distinguished from *O. tristicolor,* first generation adults appeared in mid-July, following *O. tristicolor.* Numbers of *O. minutus* exceeded those of *O. tristicolor* by early August, by which time *O. minutus* comprised about 10% of the total predators observed in that block.

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